

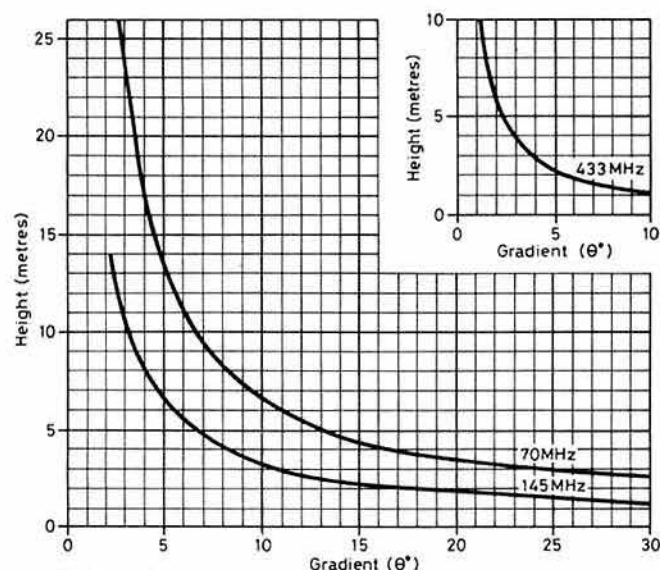


Fig 2. Graphs used to deduce optimum height of vhf antennas

equal in strength and there will be a doubling of the signal in the desired direction. Sadly, most mountain sites are of very poor conductivity, if rocky, to fair if with grassy slopes, but every little helps.

Incidentally, a favourite site in County Durham from where VHF NFD (restricted section) and the VHF Managers Trophy have both been won twice, is the site of much mineral workings with well-grassed slopes facing towards SE England, which seems to prove the idea by "the proof of the pudding is in the eating" theorem.

If you don't believe any of this article try the following simple test: Select a suitable site with a clearly defined peak and slopes all around. Try the Malvern Beacon.

Items required:

1. A handheld 144MHz fm rig with an s-meter. I use a TR2300 with a whip antenna – not a rubber duck.
2. A large-scale map of the area and a compass.

Procedure: Select a distant busy repeater, adjust the handheld's antenna to get a mid-scale s-meter reading. Start at the peak of the site and, holding the handheld at arms length and at about 3ft above ground, walk up and down the slope with the handheld correctly positioned for 50yds or so, and see which direction gives the highest S-meter reading. Carefully "tune" the site for maximum s-meter reading. Now plot the bearing from the point at the top of the slope and you will have the direction to the repeater. Check on your map to confirm this result. Watch the s-meter carefully. The increase in signal strength may surprise you, the steeper the slopes the more marked the results and you will find you can access repeaters at up to 100 miles with 1W or so. Don't forget to extend the whip antenna correctly to transmit. I don't give any hard and fast guarantee but the exercise will do you good! Please don't all go to Malvern Beacon on the same day!

After thoughts

Let me examine the conditions which enhance the performances of a vhf contest site which are outside the constraints of the actual site selected.

1. Within the UK it seems without doubt that vhf sites in the southern counties and the Channel Islands perform on average better than sites in the North of England or GM. The further north you go, the worse in general are vhf performance (ask any GM).
2. Sea paths enhance signal performance but long land paths definitely attenuate signals to a large degree, produce more scatter and deeper QSB. If you do have to suffer a land path it seems better if it is over low, gently rolling or fen-like countryside. Nearly all GM is "hidden" behind the most mountainous and broken parts of Northern England, and unless with a sea path or at great height, tend to give poor results.
3. The performance of a site in regard to winning vhf contests is to a large extent dependent on certain variables. The contest rules, with a scoring system based on the radial rings system, produce a very fair system of results but there is a critical distance versus practical vhf range performance which determines results. Go too far away from what is laughingly referred to as the centre of gravity of the UK amateur population (somewhere just north of Watford) and the results drop to a very poor level. Go to GM and they rise again!

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KEEPING THE TOWER IN TRIM

R W Addie, G8LT*

A tower is a sizeable investment for the amateur and therefore merits some care and attention. It is assumed that it is already erected, and this article deals with the various forms of protection suitable both for the structure itself and for the running rigging involved. The author goes on to discuss points involved in mounting rotators and bearings. Particular attention is focused on matters of safety. He concludes with a look at antenna rigging in more general terms and from the point of view of the amateur at home rather than the more nautical outlook of the yachtsman. The object is to take the worry out of having things aloft so that the operator may sleep more soundly o'nights!

The tower

So, that big hole was dug and has been backfilled with much care, the compass has done its job, the concrete hardens and the last of the helpers depart, leaving you to admire your pride and joy finally pointing skywards. Forgotten is that awkward planning authority and the attack of financial cramp occasioned by your purchase. At such times the mind does not dwell on possible disasters to come, but it pays to spare some thought to simple measures to look after the thing now that it's up. Whether it be free-standing or the popular crank-up and luff-over type, if it is made of welded steel it most likely has a galvanised finish, whereas light alloy versions will have only rudimentary protection, if any.

Those living within reach of salt-laden winds should consider, at an early stage, some way of preventing the resulting damage. The effect of sea salt on zinc galvanizing is well known to those living near the sea and, if time allows, it is a good idea to apply a coat of protective marine paint or Galvanite before the tower is put in place. While this is a tedious business, the long-term advantages are enormous and can add years to the tower's life. If you have the tilt-over type, the job is more easily done in the horizontal position. A red-lead undercoat followed by a mid-leaf green blends well with most home surroundings.

Ropes and rigging

Running rigging, which is usually semi-flexible wire rope, merits different treatment. It is not necessary to de-rig this but, if not already assembled or in the case of replacement, the following ideas may help. Most wire rope consists of several "lays" of steel wire surrounding a hemp core. If a good grease such as multipurpose lithium-based "Retinax A" can be worked in the core, the life is much extended. I experimented by stretching the new rigging between two points, applying the grease with an old paint brush, and then coiling the lot up and stowing it in a large plastic sack which was left in the sun for as long as possible. The heat in the sack effectively allowed the grease to work through the steel lays and into the hemp core. (You could try using a low oven in the kitchen if the xyl isn't looking; the smell is nowhere as bad as potting homemade transformers in black pitch!) If this treatment has to be done *in situ*, first apply a liberal coating to the cables that operate the luffing gear, since these are under great strain when in use. At the same time, grease the pulley blocks over which the cable runs; the pulley bearings can be oiled to avoid dismantling for greasing. The telescopic hoist cable should be treated similarly and, in both cases, ensure there are no "spikes" sticking out of the wire which indicate a broken strand and future weak spot. There is no reliable cure for this condition and replacement of the affected rope should be carried out. In general there is no need to grease the sliding sections of a telescopic tower, as that makes it messy and dirty to handle when dust and insects stick to it.

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Safety

The consequences of catastrophic failure in the running rigging are both dire and expensive. If a hoist cable fails, you are left with an hf beam looking like an umbrella that's been in a gale. It takes a lot shorter time to come down than to wind up! A luffing gear disaster can be really dangerous and happens all too quickly. When luffing a tower, *always* wind it down to its lowest height before removing a locking pin, and do not let any helper stand in the area into which the tower is to be tilted. By the same token, unless you have a braked winch, do not let go of the luffing winch handle. If you do, it will take off, revolving at high speed and could well break a wrist or arm. It won't do the antennas much good either! I have seen this happen and what a frightening sight it was. It came down with the end of the hf boom pointing downwards, as the beam had been swung to this position for best access to the antennas when luffed. It taught me another lesson; namely, that a good sleeve bearing for the drive shaft above the rotator is worth providing; nothing but my pride suffered.

Some torsional movement, especially in the section carrying the rotator, is a positive advantage in reducing stresses when a heavy beam assembly is braked. The mounting of a rotator in a head section gives rise to problems of its own. I have already touched on the subject of head bearings. While the main downward thrust from the weight of the beam(s) is taken by bearings in the rotator, provision must be made for containing lateral forces induced by wind. Most head sections provide for one or more sleeve bearings through which goes the drive shaft that is clamped to the rotator itself. The alignment of these needs care in getting the shaft exactly on the rotator centre line. Failure to do so cannot only damage the rotator bearings but, in extreme cases, cause the fixings to break. Rotators such as the HAM-M can either be fixed directly to the platform in the head unit or fitted with a spacer which lifts it clear of the platform to allow easier connection of the control cable. Final centering of the drive shaft is achieved by inserting shims between the shaft and rotator casting.

The fixing bolts so often provided are simple 0.25in mild steel, albeit plated, which mate with threaded holes in the bottom casting of the rotator. In my experience these, in the longer term, are useless and tend to shear off under the torsional forces occasioned by braking and wind. It is a good idea to throw them away at the start and substitute high-tensile bolts of the same size and with good lock washers. Stainless steel is excellent for such bolts, though more expensive. Having suffered in this way, I finally dismantled my rotator, drilled the fixing holes and re-tapped them for 8mm, and fitted stainless steel bolts, since when no further trouble has arisen. If you decide to drill the casting without dismantling, use lots of thick grease on both drill and tap to remove all traces of swarf. Ideally there should be no "slop" in your top bearings, and grease well before tightening down that rotator.

Standing rigging

If your tower is to be self-supporting, there is little else that needs doing at the start. If you decide to fit guys, then the standing rigging will need thought. Ropes suitable for guying purposes are best chosen from one of the man-made fibres, such as polypropylene or terylene. The latter is the better choice in countries where they are exposed to bright sunlight. These materials, while having good strength, do not rot and are impervious to oil and the hazards of weather. Like their steel counterparts, they follow the traditional form, consisting of three strands laid spirally together. When purchasing, remember that the old method of specifying size was by quoting the circumference and not the diameter. Now that metric units are established you may find the rope size given as a diameter in millimetres, eg 8mm dia = 1in circumference. A popular size approximates to 0.75in circumference; this fits other useful rigging items such as pulley blocks, thimbles and rigging screws, of which more will be mentioned.

These man-made fibres, being plastic, are susceptible to heat, which can cause damage if chafing occurs, but this is a most useful property as it greatly assists cutting and sealing. For this, you can use either a chisel-pointed soldering iron or a naked flame, but try not to use a knife as the lays and the individual filaments of the material will spring apart, leaving you with something akin to a very small bunch of flowers! Choose the place for cutting, lay the rope flat on a hard surface, such as a piece of sheet-metal offcut, and press the hot chisel bit down on the rope with steady pressure until it parts. This procedure will most probably have sealed off the two ends. The same effect can be achieved with a pencil-thin gas flame, where you hold the rope in both hands and offer the selected spot to the flame while keeping a gentle pull. When it parts, the two ends will be molten, and I do advise a quick squeeze with pliers to

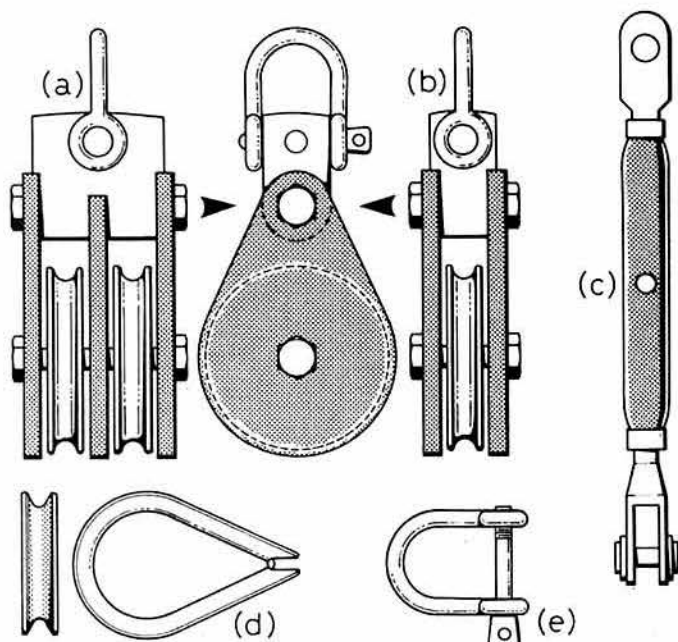


Fig 1. (a) Twin-sheave marine type block. (b) Single-sheave block. (c) Rigging screw. (d) Heart-shaped thimble. (e) "D" shackle

compact them; do not use fingers, as the molten plastic can stick to them and give a bad burn. Alternatively, rotate each end in turn in the flame until a blob forms, and cool it by blowing. This invariably works.

Should you decide to make a super job by then splicing the rope end into an insulator, thimble or rigging screw, you should unlay each of the strands and seal each in turn, just as you did the rope itself. Splicing these ropes need not be as daunting as it sounds, and it provides an immensely strong fixing that will last for years and looks good too. A spliced rope retains 90 percent of its initial strength, whereas, if knotted, it is reduced to only 50 percent. This fact may surprise the "galvanised pulley and washing-line" brigade who have to rush outdoors after every storm! A little book by C L Day published originally by Adlard Coles entitled *Knots and Splices* contains excellent photographs and explanations to enable even the beginner to achieve success.

While halyards can be spliced directly into insulators, guys are best terminated in thimbles. These are heart shaped with a groove round the outside in which the rope lies and the rope end may be spliced into the guy close up to the pointed end of the thimble. The cheapest thimbles are of galvanised steel, although nylon can sometimes be used; stainless steel is far too expensive. Be sure to buy the right size of thimble to fit your guy rope. The guy with its thimble in place can now be attached either to an eye on the tower or to a steel picket, suitably drilled and driven into the ground. (It is wise to wrap something like sacking round the picket head after driving it in as, unprotected, it can inflict nasty injuries on the shins of the unwary.) Use "D" shackles to attach the guys (again, galvanised steel is cheaper) by putting the shackle body through the thimble, and the shackle pin through the body and the eye or drilled hole in the picket, and then tightened up. Unless you have a "shackle knife", use a hardened tool like an Allen key to fit the hole in the shackle pin. Pliers are not recommended. A touch of grease on the thread will assist removal in the future.

To keep guys strained up to the required tension, rigging or "bottle" screws are useful things. At each end of the screw is an eye with a long threaded stud which fits the rigging screw body. These threads are cut in opposite sense so that, depending on the direction in which the body is rotated, the length between the two eyes can be varied. Thus inserted in a guy, the screw can be lengthened or shortened at will. The body may be of the open type but performs the same duty.

Raising the antenna

To raise and lower antennas, some form of pulley block is required, and it is well worth buying the marine type with Tufnol cheeks and sheaves, which may also have stainless steel straps at the side and an integral swivel. Unlike galvanised pulleys, these really do last for years and do not rust and chafe the halyard. To fix one to a handy tree branch, try making a strop; ie a length of rope with a thimble at one end and a loop at the

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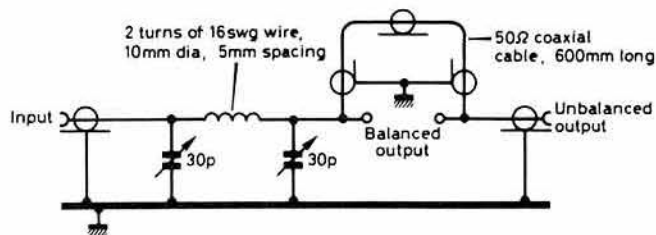


Fig 12. A 144MHz pi-network atu providing balanced and unbalanced output as described by G3UUS in a 1983 *Ham Radio Today*

Dave Ackrill, G0DJA, finds a 144MHz atu (Fig 12), described originally by G3UUS in a 1983 *Ham Radio Today*, useful when experimenting with vhf long-wire antennas along the lines of that described by G8NDJ (*TT* December 1987). He uses a 30m wire, with 94cm of 75Ω and a counterpoise 381cm long.

In the March 1988 *TT*, Del Arthur, G0DLN, showed how he had converted a wartime BC348R receiver (i.f. 915kHz) into a six-band exciter

for a QRP cw transmitter/transceiver, using the bfo and the local oscillator as a mixer (heterodyne) vfo. This has prompted John Roscoe, G4QK, to warn that problems of spurious radiation could arise, particularly with receivers having the more common wartime i.f. of 455kHz. He writes: "If I follow G0DLN correctly, he is in danger of producing two frequencies on transmission, the unwanted one being the usual 'second channel' spaced twice the i.f. away (ie 1,830kHz) from the desired frequency. There may be sufficient post-mixer selectivity to reduce to an acceptable level the image frequency with the i.f. used in the BC348R but this is unlikely to be the case with an i.f. of 455kHz (second channel 910kHz spacing) with the limited attenuation likely to be produced in a single rf stage. This is a pity. In the HRO, for example, the first oscillator, running at enormous output (sufficient sometimes to cause tvi to vhf television) had the valve anode at zero rf potential. An output taken from that point had some buffering from the tuned circuit and could be used to drive a transmitter. I did just that – but only on 3.5MHz."

In the March 1988 *TT* I gave the old address for the Siliconix publicity department in connection with the application notes for the Si8901 mixer ic. The new address is: Marketing Services, Siliconix Ltd, 3 London Road, Newbury, Berks RG13 1JL (tel 0635 30905). □

MOXON SLOPES AT VHF AND OTHER THOUGHTS

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4. These days, being in a rare county or rare QRA locator square can enhance site performance, as can a GM, GI, GD or GW callsign.

5. It's just an afterthought, but saying you are in GM when you're not, or you're in AN square when you're in ZN or using 1kW instead of 50W on 70MHz helps enhance your score no end but in the spirit of amateur contest working is not to be recommended. All seem to be undetectable in practice!

References

- [1] L Moxon, G6XN. *Wireless World* April 1970.
- [2] B Chambers, G8AGN. Sheffield University.

Acknowledgements

1. Mr L Moxon, G6XN, for unknowingly provided aid to a vhf contest man.
2. The Westmoreland VHF Group (in particular G3JYP) for disagreeing with me (some of the time) and helping me move antennas into widely unlikely spots (all of the time) and without who's encouragement and help I would never have been a member of a consistently winning team.
3. G3BA and G3SEK for help and technical know-how.
4. G8AGN of Sheffield University for putting the maths right. □

KEEPING THE TOWER IN TRIM

(Continued from page 344)

other. To fit, pass the loop end over the branch and then pass the thimble end through the loop, and pull tight. The pulley block, with its halyard already in place, is then shackled to the strop. The counterweight I must leave to your ingenuity.

When making metallic connections, whether guys or feeders for direct drive, it must be remembered that dissimilar metals in contact and in the presence of moisture induce an electrolytic action at the point of contact. This is nicely shown in *Radio Data Reference Book*, page 207. If, therefore, a nickel-plated fastening is fixed to the galvanised tower, the risk of corrosion is more likely than if the clamp were silver plated. Bearing this in mind, always ensure that the contact surfaces are first dried and, after the connection is made, the joint is given a coat of protective paint to keep moisture out. Copper and zinc make an effective battery! Should the galvanising have been worn through either by rust or abrasion, it can be rubbed down to the base metal and dressed with Finnigan's Hammerite which inhibits rust and protects the surface at the same time.

Conclusion

Should you decide to buy a secondhand tower, I believe the first and most important point is to determine that it is structurally sound. If of the telescopic type, each section should be inspected to see that it has not been bent by excessive stress and that the sections slide within each other without jamming. Obviously you will look at the galvanising, if any, for

signs of rust showing through. An even closer check should be made on the running rigging, for reasons highlighted earlier in this article; your life and that of others may literally depend on it. Have a look for those "spikes" I mentioned, and discount the price if any are in evidence, since that cable ought to be replaced before it is used. Subject the winches to close scrutiny for the same reason. In short, very much a case of *caveat emptor!* I have omitted to mention the herculean task of uprooting a support post embedded in 6ft of concrete. It is probably cheaper to buy a new post from the makers. Once you are the proud owner, you will find it pays to look after it as well as you do your car.

What I have written is largely commonsense but, being culled from the experience of my own stupidity, it is offered to prevent others from being as foolish as I!

Acknowledgements

To Strumech Versatower Ltd, for their Service Training Brochure and Notes to Users on maintenance procedures, and to G4IXD and G5TU for help and advice.

Bibliography

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Ropes and Rigging for Amateurs – A professional approach, J M Gale, G3JMG. *Radio Communication* March 1970, page 144.
Radio Data Reference Book, G R Jessop, RSGB. □

IN MEMORIAM

The Society records with regret the deaths of the following radio amateurs:

Mr F D J Bartlett, G4JHX, on 3/3/88.

Mr S Brister, G6AK, 18/2/88, aged 78.
 Mr D Brown, G0DPW, 27/2/88.
 Mr B Cannell, GM3CZX, 29/2/88.
 Mr B J Creamer, G4UYS, 20/10/87.
 Mr G E Edwards, G4MBX, 3/9/87.
 Mr E Edwards, GW3INV.
 Mr D Frost, G3UQP.
 Mr Gratton, G6ZEE, 16/2/88.
 Mr W H Hatch, G0BKM, 29/1/88, aged 62.
 Mr P Horwood, G3FRB, Jan 1988.
 Mr A H Hope, GW0CKJ, 16/3/88, aged 71.
 Mr W Hyams, G0BWH, 6/12/87.
 Mr T C Jones, G6OAT, 14/3/88.

Mr K W Lee, G3VSO, Jan 1988.
 Mr K S Livermore, G3LOL, 19/2/88.
 Mr K McArdle, G4CRI, 27/3/88, aged 64.
 Mr G C Pratt, G1NPZ, 28/2/88.
 Mr P J Revill, G3ZZR, 17/8/87.
 Mr B Saunders, G1ORQ.
 Mr R Staples, G3MMD.
 Mr S A Taylor, G5TL, 16/10/87.
 Mr S G Thorn, G2FSJ, 17/2/88.
 Mr R J Wallace, G4DIB, 3/11/87.
 Mr S F Whetstone, RS40338, Nov 1987.
 Mr A W Wright, G4WTM, Oct 1987.
 Mr D Wrightson, G3BTO, 13/11/87.